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(54) **FLEX TO FLEX CONNECTION DEVICE**

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CPC **H01R 12/77** (2013.01); **H01R 12/16** (2013.01); **H01R 12/78** (2013.01); **H01R 12/79** (2013.01); **H01R 13/5208** (2013.01); **H01R 13/5219** (2013.01); **H01R 13/62** (2013.01)

(58) **Field of Classification Search**

CPC H05K 3/365; H01R 12/78; H01R 12/61
See application file for complete search history.

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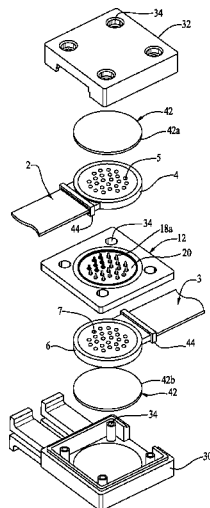
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(57) **ABSTRACT**

A mechanical device for electrically connecting a first flexible assembly to a second flexible assembly comprises a wafer and a housing. The wafer has an insulator core and a plurality of wafer electrical connectors. The core has a first base side and an opposed second base side. The wafer electrical connectors include a first set of wafer electrical connector contacts exposed on the first base side and a second set of wafer electrical connector contacts exposed on the second base side. The wafer electrical connector contacts are adapted to electrically connect with each of the flexible assembly electrical contacts. The housing retains the wafer, the first flexible assembly terminal, and the second flexible assembly terminal in such a way that each of the first flexible assembly electrical contacts is removably secured and electrically connected to one of the wafer electrical connector contacts.

13 Claims, 4 Drawing Sheets



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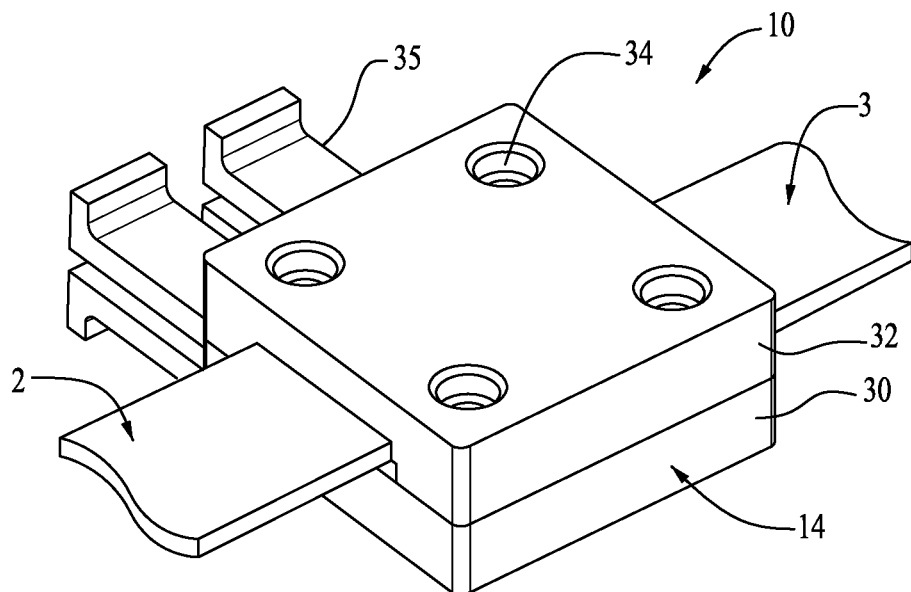


Fig. 1

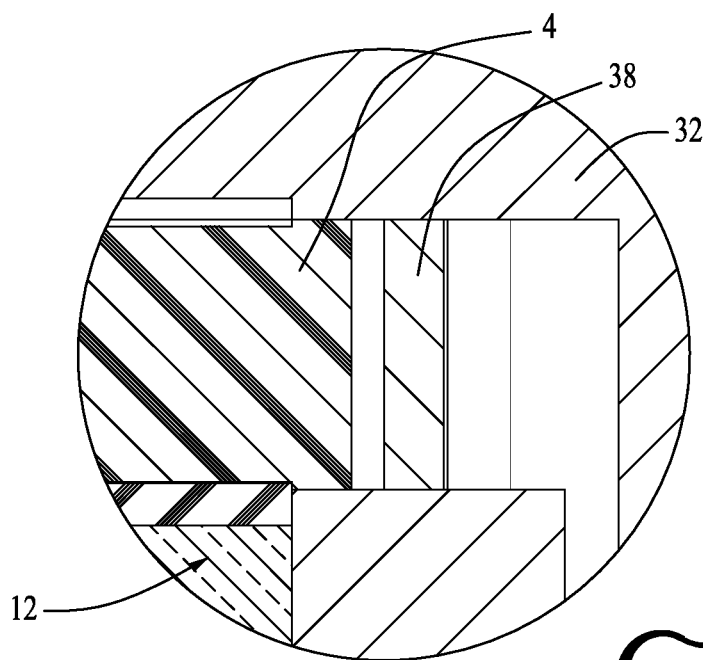
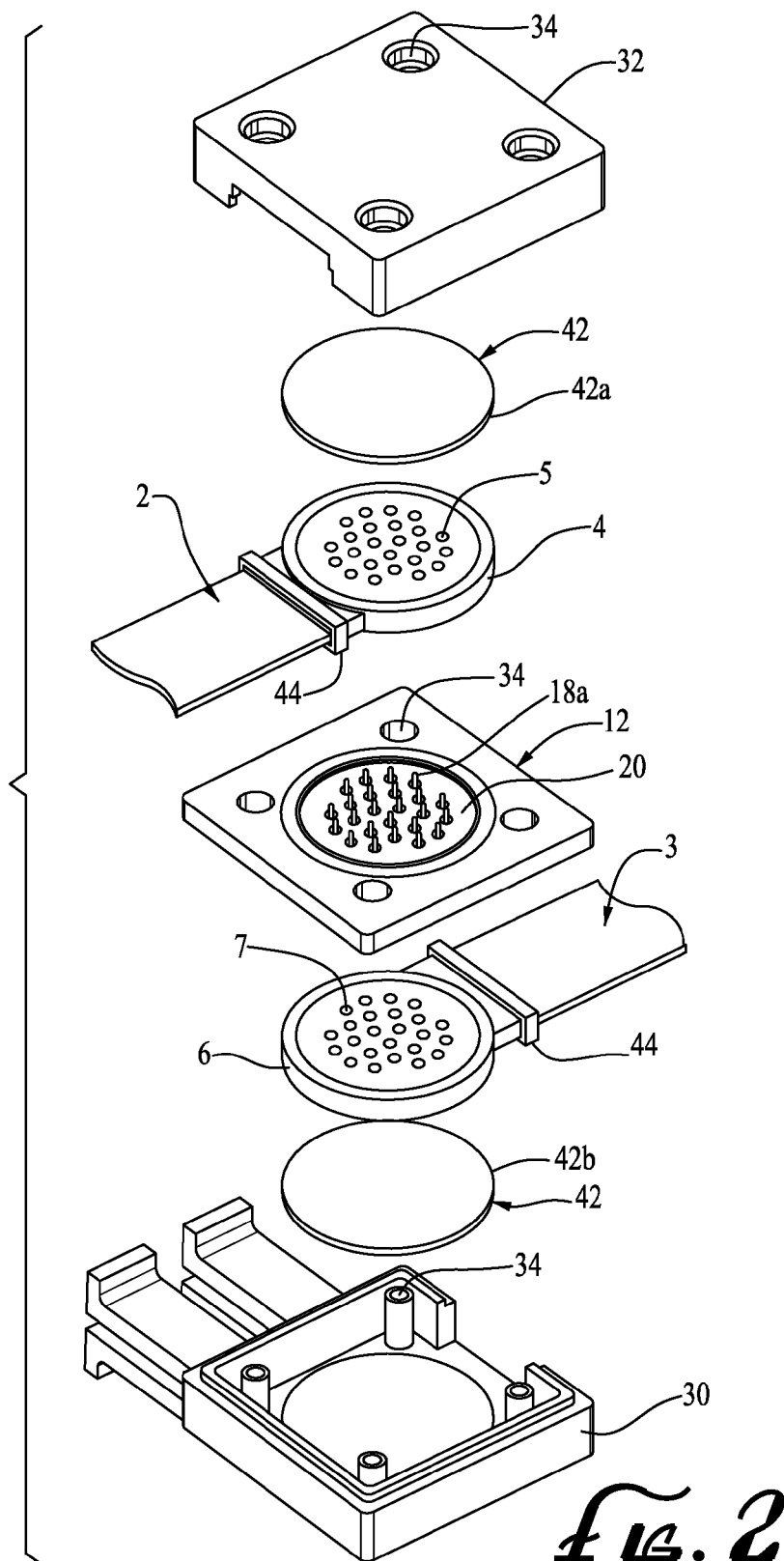
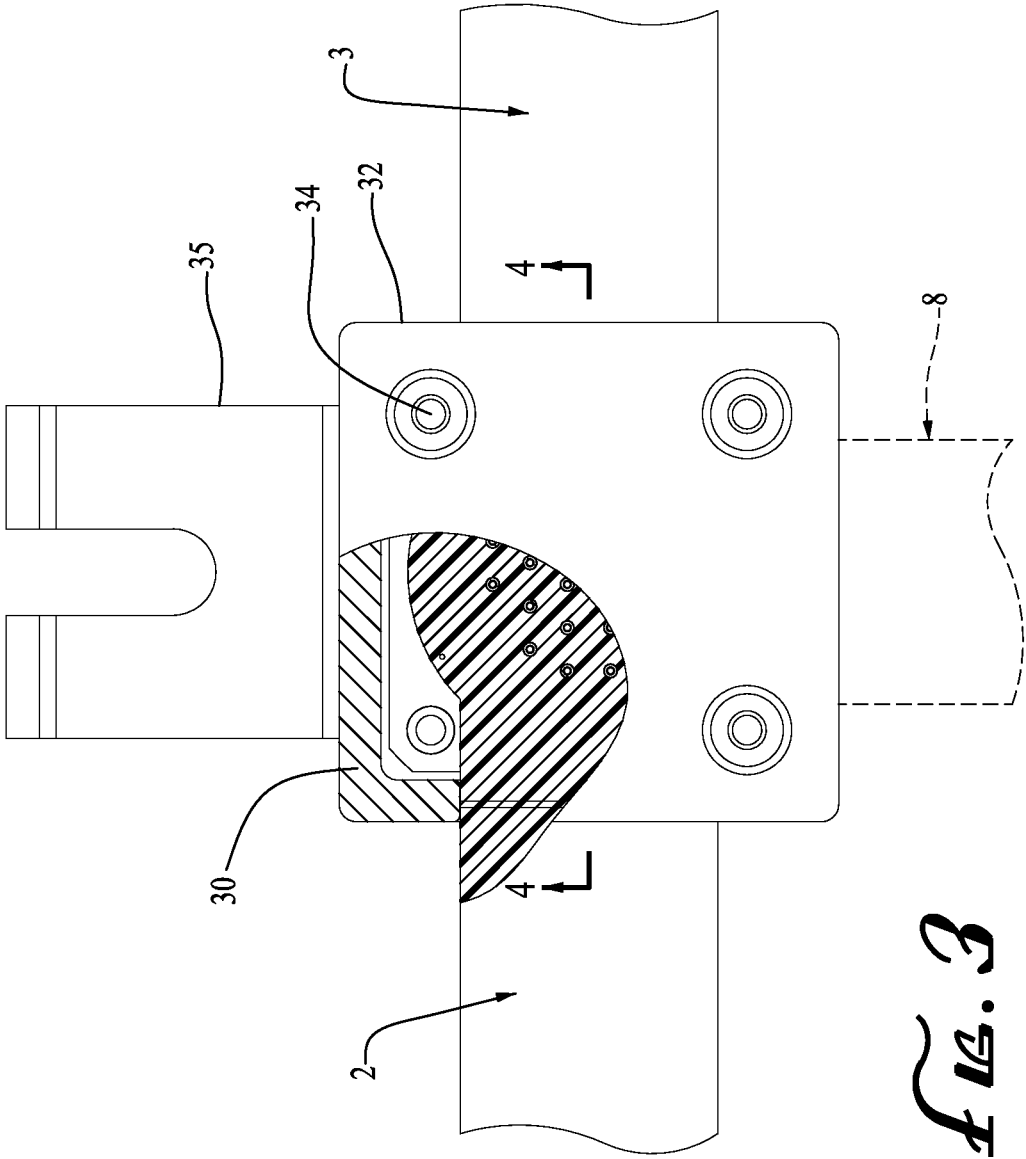


Fig. 5





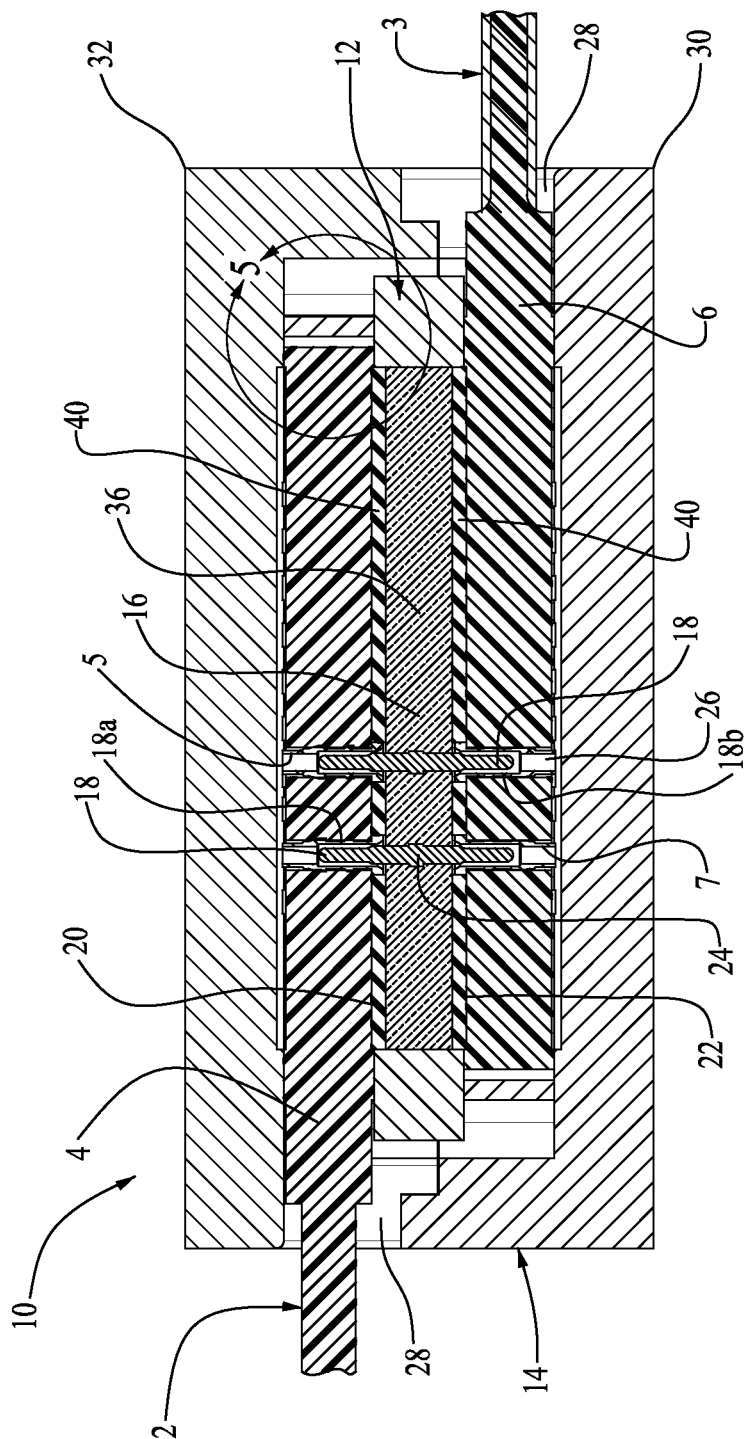


fig. 4

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FLEX TO FLEX CONNECTION DEVICE**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a continuation of U.S. application Ser. No. 13/961,591, filed on Aug. 7, 2013; which is a continuation of U.S. application Ser. No. 13/398,624, filed on Feb. 16, 2012; which claims priority from U.S. Provisional Patent Application Ser. No. 61/444,681, filed Feb. 18, 2011, and claims priority from U.S. Provisional Patent Application Ser. No. 61/450,076, filed Mar. 7, 2011, specifications of which are herein incorporated by reference in their entirety.

FIELD OF THE INVENTION

The invention relates generally to electrical connection assemblies and, more particularly, to connection assemblies comprising a pair of flexible electrical conductors.

BACKGROUND OF THE INVENTION

Sophisticated electrical and electronic components are frequently disposed proximate to high vibration equipment, such as aircraft and rocket engines. Because of the narrow confines wherein such components are typically disposed, interconnecting such components often employs the use of flexible electrical conductors ("flexible assemblies").

The prior art methods of attaching a flexible assembly to another flexible assembly usually employ some form of permanent attachment, such as methods wherein the flexible assemblies are soldered to one another.

Problems arise in such prior art methods when the attachment between the two flexible assemblies fails. Such failures cannot easily (if at all) be repaired in the field, and, in most cases, require the complete replacement of both flexible assemblies. Such complete replacement of both assemblies can be awkward, time-consuming and expensive.

Accordingly, there is a need for a method of attaching a flexible assembly to another flexible assembly which does not involve the aforementioned problems in the prior art.

SUMMARY OF THE INVENTION

The invention satisfies this need. The invention is a mechanical device for electrically connecting a first flexible assembly to a second flexible assembly, wherein the first flexible assembly comprises a first flexible assembly terminal end having a plurality of first flexible assembly electrical contacts and the second flexible assembly comprises a second flexible assembly terminal end having a plurality of second flexible assembly electrical contacts, the invention comprising (a) a wafer comprising an insulator core and a plurality of wafer electrical connectors, the core having a first base side and an opposed second base side, the wafer electrical connectors comprising a first set of wafer electrical connector contacts exposed on the first base side and a second set of wafer electrical connector contacts exposed on the second base side, each electrical contact in the first set of wafer electrical connector contacts being electrically connected to a corresponding electrical contact in the second set of wafer electrical connector contacts, each wafer electrical connector contact being sized and dimensioned to electrically connect with a first flexible assembly electrical contact or a second flexible assembly electrical contact, and (b) a housing for accepting and retaining (i) the wafer, (ii) the first flexible assembly terminal end disposed adjacent to the first base side

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of the wafer, and (iii) the second flexible assembly terminal end disposed adjacent to the second base side of the wafer, such that each of the first flexible assembly electrical contacts is removably secured and electrically connected to the first set of wafer electrical connector contacts and each of the second flexible assembly electrical contacts is removably secured and electrically connected to the second set of wafer electrical connector contacts.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view of a mechanical device of the invention;

FIG. 2 is an exploded view of the mechanical device illustrated in FIG. 1;

FIG. 3 is a top view in partial cross-section of the mechanical device illustrated in FIG. 1;

FIG. 4 is a cross-sectional side view of the mechanical device illustrated in FIG. 1; and

FIG. 5 is a detail view of a portion of the mechanical device illustrated in FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

The following discussion describes in detail one embodiment of the invention and several variations of that embodiment. This discussion should not be construed, however, as limiting the invention to those particular embodiments. Practitioners skilled in the art will recognize numerous other embodiments as well.

The invention is a mechanical device 10 for electrically connecting a first flexible assembly 2 to a second flexible assembly 3. The first flexible assembly comprises a first flexible assembly terminal end 4 having a plurality of first flexible assembly electrical contacts 5, and the second flexible assembly comprises a second flexible assembly terminal end 6 having a plurality of second flexible assembly electrical contacts 7. The invention comprises a wafer 12 and a housing 14.

The wafer 12 is responsible for passing electrical signals and/or power distribution from one flexible assembly to the other.

The wafer 12 comprises an insulator core 16 and a plurality of wafer electrical connector contacts 18. The insulator core 16 can be a hermetic glass insulator 36.

The wafer electrical connector contacts 18 comprise a first set of wafer electrical connector contacts 18a exposed on a first base side 20 of the wafer 12 and a second set of wafer electrical connector contacts 18b exposed on a second base side 22 of the wafer 12. Each electrical contact 18 in the first set of wafer electrical connector contacts 18a is electrically connected to a corresponding electrical contact 18 in the second set of wafer electrical connector contacts 18b. Each wafer electrical contact 18 is sized and dimensioned to electrically connect with a first flexible assembly electrical contact 5 or a second flexible assembly electrical contact 7.

The contacts 5, 7 and 18 are reversible, in that they are readily replaceable and can be readily disengaged and reengaged without tools. The contacts 5, 7 and 18 are typically either double-ended pins 24 or double-ended sockets 26. The wafer 12 can have pin and/or socket electrical connector contacts of varying sizes.

The wafer electrical connector contacts 18 are typically spaced apart across the wafer 12. The wafer 12 can have dissimilar contact patterns on opposed sides of the wafer 12. The wafer 12 can be configured in various contact densities and patterns.

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The wafer 12 can also comprise EMI/EMC bonding mechanisms and can include environment sealing features.

The wafer 12 can be constructed to be an active device, such as a device capable of acting as a transducer, Diode, capacitor or other electronic component, by attaching or embedding circuitry and/or electrical components therein.

The wafer 12 can be manufactured from various materials and can employ various dielectric materials.

The housing 14 is sized and dimensioned to accept and retain the wafer 12, the first flexible assembly 2 and the second flexible assembly 3. The first flexible assembly terminal end 4 is disposed adjacent to the first base side 20 of the wafer 12 and the second flexible assembly terminal end 6 is disposed adjacent to the second base side 22 of the wafer 12, such that each of the first flexible assembly electrical contacts 5 is removably secured and electrically connected to the first set of wafer electrical contacts 18a and each of the second flexible assembly electrical contacts 7 is removably secured and electrically connected to the second set of wafer electrical contacts 18b.

The housing 14 incorporates multiple entry and exit locations 28 for the flexible assemblies 2 and 3.

The housing 14 is typically stackable and comprises a base 30 and a top cover 32. The top cover 32 is secured to the base 30 by reversible fasteners. In the embodiment illustrated in the drawings, bores 34 are provided at each corner of the housing 14 to facilitate securing of the top cover 32 and the base 30 by bolts. Alternatively, the top cover 32 and the base 30 can be secured by nut and bolt pairs, clips, clamps or other equivalent reversible fasteners. Typically, the base 30 and the top cover 32 are made of interlocking construction for EMI and fire protection.

In the embodiment illustrated in the drawings, the housing 14 further comprises installation brackets 35.

The housing 14 can be made from a multitude of materials, including, but not limited to, aluminum, titanium, steel, plastic, PEEK and many different composite materials.

The housing 14 can be adapted to accommodate flexible assemblies having any shaped terminal end.

The housing 14 can also serve as an enclosure for various additional accessories, such as a mounting device.

The device 10 of the invention also typically comprises a double-ended grounding pad 38 and an interfacial seal 40.

The device 10 of the invention can also comprise gaskets 42 and/or grommets 44 to serve an array of functions, such as environmental sealing, EMI bonding, EMC bonding, vibration dampening and air volume reduction. The gaskets 42 can serve as a first spacer 42a and a second spacer 42b. The first spacer 42a is disposed between the housing 14 and the first flexible assembly 2 and the second spacer 42b is disposed between the housing 14 and the second flexible assembly 3.

It should be noted that the device can be adapted to electrically connect more than two flexible assemblies. For example, FIG. 3 illustrates the electrical connection of a first flexible assembly 2, a second flexible assembly 3 and a third flexible assembly 8.

The device 10 of the invention employs no solder or other permanent, nonreversible connections with the terminal ends of the flexible assemblies 2 and 3.

Having thus described the invention, it should be apparent that numerous structural modifications and adaptations may be resorted to without departing from the scope and fair meaning of the instant invention as set forth hereinabove and as described hereinbelow by the claims.

What is claimed is:

1. A connector assembly for flex to flex connection comprising:

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a housing configured for electrically coupling a plurality of flexible assemblies, each one of said plurality of flexible assemblies having a terminal end with a plurality of electrical contacts; and

a wafer with a first base side and an opposed second base side, said wafer comprising an insulator core with a plurality of wafer electrical connector contacts configured to electrically couple a terminal end of a first one of said plurality of flexible assemblies at said first base side to a terminal end of a second one of said plurality of flexible assemblies at said second base side, wherein said wafer further comprises an interfacial seal and a circumferential double ended grounding pad on each of said first base side and said second base side.

2. The connector assembly of claim 1, further comprising one or more gaskets configured to be placed between an inside wall of said housing and a terminal end of a flexible assembly.

3. The connector assembly of claim 1, wherein said plurality of wafer electrical connector contacts comprises pins.

4. The connector assembly of claim 1, wherein each one of said plurality of electrical contacts at said terminal end of a flexible assembly is a socket and a corresponding one of said plurality of wafer electrical connector contacts is a pin configured to tightly couple with said socket.

5. The connector assembly of claim 1, wherein each one of said plurality of wafer electrical connector contacts is replaceable.

6. The connector assembly of claim 1, wherein said housing comprises a top cover and a bottom cover, said top cover configured to be secured to said bottom cover using reversible fasteners.

7. The connector assembly of claim 1, wherein said insulator core comprises hermetic glass.

8. A connector assembly for connecting flexible assemblies comprising:

a housing configured for coupling a plurality flexible assemblies in a stackable configuration, wherein each one of said plurality of flexible assemblies comprises a terminal end with a plurality of electrical contacts; and at least one wafer, wherein one of said at least one wafer is configured to be located between a terminal end of a first one of said plurality of flexible assemblies and a terminal end of a second one of said plurality of flexible assemblies, each of said at least one wafer comprising:

a first base side and an opposed second base side;

an insulator core with a plurality of wafer electrical connector contacts configured to electrically couple said first one of said plurality of flexible assemblies at said first base side to said second one of said plurality of flexible assemblies at said second base side;

an interfacial seal on each of said first base side and said second base side; and

a circumferential double ended grounding pad on each of said first base side and said second base side.

9. The connector assembly of claim 8, further comprising one or more gaskets configured to be placed between an inside wall of said housing and a terminal end of a flexible assembly.

10. The connector assembly of claim 8, wherein one of said plurality of electrical contacts at said terminal end of a flexible assembly is a socket when a corresponding one of said plurality of wafer electrical connector contacts is a pin, and said one of said plurality of electrical contacts at said terminal end of said flexible assembly is a pin when said corresponding one of said plurality of wafer electrical connector contacts is a socket.

11. The connector assembly of claim 8, wherein each one of said plurality of terminal end electrical contacts is a socket and a corresponding one of said plurality of wafer electrical connector contacts is a pin configured to tightly couple with said socket.

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12. The connector assembly of claim 8, wherein each one of said plurality of wafer electrical connector contacts is replaceable.

13. The connector assembly of claim 8, wherein said housing comprises a top cover and a bottom cover, said top cover 10 configured to be secured to said bottom cover using reversible fasteners.

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